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TO: Commissioner for Patents

FAX NO.: 703-872-9306

FROM: Keith Taboada, Esq.

DATE: June 30, 2005

MATTER: Serial No. 10/716,096 Filed: November 18, 2003

DOCKET NO.: 761C4/CPI/L/B/PJS

APPLICANT: Danek, et al.

The following has been received in the U.S. Patent and Trademark Office on the date of this facsimile:

___ Petition
___ Disclosure Statement & PTO-1449
___ Priority Document
___ Drawings (____ sheets) informal
___ Amendment
X Appeal Brief (17 pages)
___ _____

X Transmittal Letter (2 copies)
X Fee Transmittal (2 copies)
X Deposit Account Transaction
X Facsimile Transmission Certificate dated June 30, 2005
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Tara Carter — Name of person signing this certificate

Tara Carter — June 30, 2005 — Signature and date

378654-1

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TRANSMITTAL FORM

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Total Number of Pages in This Submission

Application Number	10/716,096
Filing Date	November 18, 2003
First Named Inventor	Danek, et al.
Art Unit	1763
Examiner Name	Lund, Jeffrie Robert
Attorney Docket Number	761C4/CPI/L/B/PJS

ENCLOSURES *(check all that apply)*

- ☒ Fee Transmittal Form
- ☐ Fee Attached
- ☐ Amendment / Reply
- ☐ After Final
- ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
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- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
- ☐ Reply to Missing Parts under 37 CFR1.52 or 1.53
- ☐ Drawing(s)
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- ☐ Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
- ☐ Proprietary Information
- ☐ Status Letter
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  Appeal Brief (17 pages)

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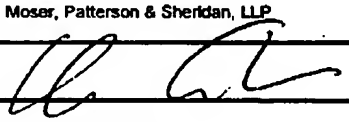
Signature			
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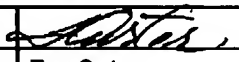
Signature			
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: **Danek, et al.**

Serial No.: **10/716,096**

Confirmation No.: **4854**

Docket No.: **761C4/CPI/L/B/PJS**

Filed: **November 18, 2003**

For: **Chamber for Constructing a Film on a Semiconductor Wafer**

§
§
§ Group Art Unit: **1763**
§
§ Examiner: **Lund, Jeffrie Robert**
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June 30, 2005 _____
Date Signature

Dear Sir:

APPEAL BRIEF

Appellants submit this Appeal Brief to the Board of Patent Appeals and Interferences on appeal from the decision of the Examiner of Group Art Unit 1763 dated March 4, 2005, finally rejecting claims 1-24. Please charge the fee of $500.00 for filing this brief and all other fees that may be required to make this Brief timely and acceptable to the Patent and Trademark Office, to Deposit Account No. 20-0782.

07/01/2005 HTECKLU1 00000052 200782 10716096
01 FC:1402 500.00 DA

PTO/SB/21 (09-04)
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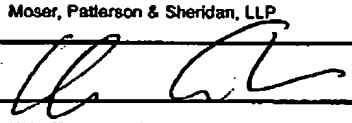
Signature			
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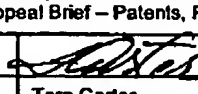
Signature			
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Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL for FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($)500.00

Complete if Known	
Application Number	10/716,096
Filing Date	November 18, 2003
First Named Inventor	Danek, et al.
Examiner Name	Lund, Jeffrie Robert
Art Unit	1763
Attorney Docket No.	761C4/CPI/L/B/PJS

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
		Small Entity		Small Entity		Small Entity	
Application Type	Fee ($)	Fee($)	Fee($)	Fee($)	Fee($)	Fee($)	Fees Paid ($)
Utility	300	150	500	250	200	100	_____
Design	200	100	100	50	130	65	_____
Plant	200	100	300	150	160	80	_____
Reissue	300	150	500	250	600	300	_____
Provisional	200	100	0	0	0	0	_____

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims	Extra Claims	Fee($)	Fee Paid ($)
_____ -20 or HP=	_____	x _____	= _____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims	Extra Claims	Fee($)	Fee Paid ($)
_____ - 3 or HP=	_____	x _____	= _____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims		
	Fee ($)	Fee Paid ($)
	_____	_____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee ($)	Fee Paid ($)
_____ - 100 =	_____ / 50 =	_____ (round up to a whole number) x		= _____

4. OTHER FEE(S)

	Fees Paid ($)
Non-English Specification, $130 fee (no small entity discount)	_____
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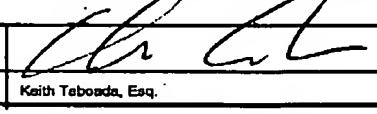
Signature		Registration No. (Attorney/Agent) 45,150	Telephone (732) 530-9404
Name (Print/Type)	Keith Taboada, Esq.		Date June 30, 2005

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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REAL PARTY IN INTEREST

The real party in interest is Applied Materials, Inc., located in Santa Clara, California.

RELATED APPEALS AND INTERFERENCES

Appellants asserts that no other appeals or interferences are known to the Appellants, the Appellants' legal representative, or assignee which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1-24 are pending in the application. Claims 1-24 stand rejected as discussed below. The rejections of claims 1-24 under 35 USC §§ 102-3 are appealed. In the Advisory Action dated May 24, 2005, the Examiner indicated that the terminal disclaimer filed in connection with the response submitted December 12, 2004 was not signed by an attorney of record. The Appellants submit that a properly executed terminal disclaimer will be filed to respond to the non-statutory double patenting rejections upon favorable resolution of the present appeal. The pending appealed claims are shown in the attached Appendix.

STATUS OF AMENDMENTS

No amendments to the claims were submitted in this application subsequent to final rejection.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention provides an apparatus for depositing and enhancing a nitride film on a semiconductor wafer. In the embodiment of independent claim 1, the apparatus includes a process chamber 112 and a showerhead 136 positioned within the process chamber 112. A metallo-organic precursor gas source (gas panel 52) is coupled to the showerhead 136 for supplying a metallo-organic precursor. A plasma annealing gas source (gas panel 52) is coupled to the showerhead 136 for supplying a plasma annealing gas. A wafer support 116 is positioned within the process chamber

112. A heater 130 is positioned proximate the wafer support 116, wherein the heater 130 supplies sufficient energy to the metallo-organic precursor to decompose the metallo-organic precursor and deposit a nitride film. At least one RF source 142 (143, 144) is coupled to the showerhead 136 and the wafer support 116, wherein the at least one RF source 142 (143, 144) couples RF energy to the showerhead 136 and the wafer support 116 to produce an annealing plasma that improves resistivity of the nitride film. (*Application*, p. 20, l. 21 – p. 22, l. 26; p. 36, ll. 3-20; p. 38, l. 11 – p. 39, l. 15; p. 41, l. 12 – p. 44, l. 3; Figs. 5, 17.)

In the embodiment of independent claim 16, the apparatus includes a process chamber 112 and a showerhead 136 positioned within the process chamber 112. A tetrakis(dimethylamido) titanium (TDMAT) and nitrogen gas source (gas panel 52) is coupled to the showerhead 136 for supplying a deposition gas mixture comprising tetrakis(dimethylamido) titanium (TDMAT) and nitrogen. An annealing gas source (gas panel 52) is coupled to the showerhead 136 for supplying an annealing gas, the annealing gas comprising at least one of hydrogen, nitrogen, helium, and argon. A wafer support 116 is positioned within the process chamber 112. A heater 130 is positioned proximate the wafer support 116, wherein the heater 130 supplies sufficient energy to the TDMAT to decompose the TDMAT and deposit a film of titanium nitride on the semiconductor wafer. A first RF source 143 is coupled to the showerhead 136 to control an annealing plasma using the annealing gas that improves resistivity of the titanium nitride film. A second RF source 144 is coupled to the wafer support 116 to control bias of the semiconductor wafer while exposing the titanium nitride film to the annealing plasma. (*Application*, p. 20, l. 21 – p. 22, l. 26; p. 36, ll. 3-20; p. 38, l. 11 – p. 39, l. 15; p. 41, l. 12 – p. 44, l. 3; Figs. 5, 17.)

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1-8, 10-16, and 18-22 stand rejected as being anticipated by United States Patent Serial No. 5,017,403, issued May 21, 1991, to *Pang et al.* (hereinafter *Pang*).

2. Claims 1-6, and 10-15 stand rejected as being anticipated by United States Patent Serial No. 5,698,062, issued December 16, 1997, to *Sakamoto et al.* (hereinafter *Sakamoto*).

3. Claims 1-22 stand rejected as being anticipated by United States Patent Serial No. 5,900,103, issued May 4, 1999, to *Tomoyasu et al.* (hereinafter *Tomoyasu*).

4. Claims 9 and 17 stand rejected as being unpatentable over *Pang* in view of *Tomoyasu.*

5. Claims 23 and 24 stand rejected as being unpatentable over *Tomoyasu* in view of Davies and United States Patent Serial No. 5,567,071, issued October 22, 1996, to *Sandhu et al* (hereinafter *Sandhu*).

ARGUMENT

1. Claims 1-8, 10-16, and 18-22 stand rejected as being anticipated by *Pang.* The Appellants disagree.

Claims 1 and 16 recite limitations not taught or suggested by *Pang.* The Federal Circuit has held that "there is no anticipation unless all of the same elements are found in exactly the same situation and united in the same way . . . in a single prior art reference". *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 894 (Fed. Cir., 1984); *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771, 218 U.S.P.Q. (BNA) 781, 789 (Fed. Cir. 1983). Here, *Pang* fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor, as recited in claim 1. *Pang* further fails to teach or suggest a tetrakis(dimethylamido) titanium (TDMAT) and nitrogen gas source coupled to the showerhead for supplying a deposition gas mixture comprising TDMAT and nitrogen, as recited in claim 16. As such, *Pang* fails to disclose all of the limitations recited in independent claims 1 and 16.

In the Final Office Action, the Examiner erroneously asserts that *Pang* discloses a metallo-organic gas source. (*Final Office Action*, p. 4, ll. 19-20; p. 10, ll. 3-5.) However, the Examiner is mistaken in alleging that HMDS (hexamethyldisilazane) is a metallo-organic compound. Specifically, a compound must contain a metal in order to be a metallo-organic compound. HMDS does not contain any metals, and therefore, is not a metallo-organic compound. Hence, *Pang* fails to fails to teach or suggest a

metallo-organic precursor gas source (or a TDMAT and nitrogen gas source) coupled to the showerhead for supplying a metallo-organic precursor (or a deposition gas mixture comprising TDMAT and nitrogen), as recited in claim 1 (and claim 16).

The Examiner further erroneously ignores certain limitations that the Examiner refers to as "process limitations." (*Final Office Action*, p. 4, l. 23 – p. 5, l. 6; p. 10, ll. 5-11.) For example, the Examiner ignores the limitations reciting the particular type of gas used (TDMAT, referred to in dependent claim 10 and independent claim 16). The Examiner relies upon a line of cases in support of his assertion that are inapposite in this instance.

Specifically, the Examiner cites to certain cases that indicate that inclusion of the material or article worked upon by a structure being claimed does not impart patentability to the claims. *See, In re Casey*, 152 USPQ 235 (preamble and functional language which incorporates a specific workpiece was considered to be patentably immaterial); *In re Rishoi*, 94 USPQ 71, 73 (liquid film formed on surface of butter churn when in use not patentably material); *In re Young*, 25 USPQ 69 (inclusion of material to be worked upon as an element of the claim may not lend patentability where the claim is not otherwise allowable); *In re Dulberg*, 129 USPQ 348 (method of pushing used lipstick out of carrier not patentable part of apparatus claim; moreover both obvious and common to remove obstruction from interior of tubular articles by pushing them out); *Ex parte Thibault*, 164 USPQ 666 ("expressions relating the apparatus to contents thereof during an intended operation are of no significance in determining patentability of the apparatus claim"); and *Ex parte Masham*, 2 USPQ2d 1647 (a recitation with respect to the material intended to be worked upon by a claimed apparatus does not impose any structural limitations upon the claimed apparatus.).

However, the language recited in Appellants' claim 1 does not recite a "material intended to be worked upon." Rather, such language includes specific definitions for the claimed elements, *i.e.*, a metallo-organic precursor gas source or a TDMAT gas source.

Moreover, none of the cited cases stand for a rule of law that functional language, or "process limitations" may not have any patentable weight in an apparatus claim. To the contrary, numerous CCPA and Federal Circuit decisions have specifically

approved of the use of functional limitations in claims and have assigned such functional limitations patentable weight. *See,* Irah H. Donner, *Patent Prosecution Practice and Procedure Before the U.S. Patent Office* 726-732 (3d ed. 1999). Notably, the CCPA specifically held a functional limitation to have patentable weight. *See, In re Land*, 151 USPQ 621, 635-36 (CCPA 1966); *In re Ludtke*, 169 USPQ 563, 566 (CCPA 1971) (stating that there is nothing prohibiting the use of functional language in a claim). *See also, In re Venezia*, 189 USPQ 149, 189 (CCPA 1976) ("there is nothing intrinsically wrong with the use of [functional language] in drafting patent claims. Indeed we have even recognized in the past the practical necessity for the use of functional language."). The Federal Circuit has specifically held a claim to be nonobvious over the prior art based on a functional limitation, where the only difference between the claim and the prior art was the functional limitation. *See, In re Mills*, 16 USPQ2d 1430, 1431-32 (Fed. Cir. 1990). Thus, the Examiner erred in not attributing patentable weight to the functional "process limitations" recited in Appellants' claims.

Lastly, after ignoring the claim limitations discussed above, the Examiner summed up the rejection by stating, "[t]his rejection is based on the fact that the apparatus structure taught by [*Pang*] has the inherent capability of being used in the manner intended by the Applicant." (*Final Office Action*, p. 5, ll. 7-8 (emphasis in original); p. 10, ll. 5-11.) The Appellants disagree.

The standard for anticipation under 35 U.S.C. §102, and case law interpreting said statute, does not refer to an "inherent capability" rejection. As stated above, anticipation requires all of the same elements to be found in exactly the same situation and united in the same way in a single prior art reference. *Perkin-Elmer*, 732 F.2d at 894. The elements may be disclosed either expressly or inherently in the single prior art reference. *Verdegaal Bros. v. Union Oil Co. of CA*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989); *see also, MPEP* §2131.

As stated above, *Pang* fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor, as recited in claim 1. *Pang* further fails to teach or suggest a TDMAT and nitrogen gas source

coupled to the showerhead for supplying a deposition gas mixture comprising TDMAT and nitrogen, as recited in claim 16. As such, *Pang* fails to disclose all of the limitations recited in independent claims 1 and 16.

Moreover, the apparatus of *Pang* does not inherently contain a metallo-organic precursor gas source coupled to the showerhead, as recited in claim 1, or a TDMAT and nitrogen gas source coupled to the showerhead, as recited in claim 16. "In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art." *Ex parte Levy,* 17 USPQ2d 1461, 1464 (Bd. Pat. App. & Inter. 1990) (emphasis in original); see also, *MPEP* §2112. Here, the apparatus of *Pang* clearly does not inherently disclose a metallo-organic precursor or a TDMAT gas source coupled to the showerhead, as recited in claims 1 and 16, respectively. Therefore, *Pang* fails to teach or suggest all of the limitations contained in independent claims 1 and 16.

Thus, the Appellants submit that independent claims 1 and 16, and all claims depending therefrom, are patentable over *Pang*. Accordingly, the Appellants request the rejection be withdrawn and the claims allowed.

2. Claims 1-6, and 10-15 stand rejected as being anticipated by *Sakamoto*. The Appellants disagree.

Claim 1 recites limitations not taught or suggested by *Sakamoto*. Specifically, *Sakamoto* fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor, as recited in claim 1.

Additional reasons for rejection under *Sakamoto* are substantially copied from the prior rejection under *Pang*. As such, the same arguments detailed above with respect to functional language and inherent disclosure apply with equal force here. *Sakamoto* fails to teach or suggest, either explicitly or inherently, a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor, as recited in claim 1. Therefore, *Sakamoto* fails to teach or suggest all the limitations recited in claim 1.

Thus, the Appellants submit that independent claim 1, and all claims depending therefrom, are patentable over *Sakamoto*. Accordingly, the Appellants request the rejection be withdrawn and the claims allowed.

3. Claims 1-22 stand rejected as being anticipated by *Tomoyasu*. The Appellants disagree.

Claims 1 and 16 recite limitations not taught or suggested by *Tomoyasu*. Specifically, *Tomoyasu* fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor and at least one RF source coupled to the showerhead and the wafer support, as recited in claim 1. *Tomoyasu* further fails to teach or suggest a TDMAT and nitrogen gas source coupled to the showerhead for supplying a deposition gas mixture comprising TDMAT and nitrogen and a first RF source coupled to the showerhead, as recited in claim 16.

In addition, the Examiner is impermissibly combining different embodiments of *Tomoyasu* that are not taught or suggested to be combinable. *Tomoyasu* first discloses embodiments of an etching apparatus. The etching apparatus of *Tomoyasu* fails to teach or suggest a metallo-organic, or a TDMAT, gas source coupled to the showerhead, as recited in claims 1 and 16, respectively. The etching apparatus of *Tomoyasu* also fails to teach or suggest a heater positioned proximate the wafer support, as recited in claims 1 and 16. (*Tomoyasu*, col. 4, l. 25 – col. 13, l. 41; Figs. 1-17.)

Tomoyasu next discloses embodiments of a CVD apparatus. The CVD apparatus of *Tomoyasu* fails to teach or suggest at least one RF source coupled to the showerhead and the wafer support, or a first RF source coupled to the showerhead and a second RF source coupled to the wafer support, as recited in claims 1 and 16, respectively. (*Tomoyasu*, col. 13, l. 42 – col. 19, l. 34; Figs. 18-43.)

The only disclosure or suggestion to utilize TDMAT, or any other metallo-organic precursor, contained in *Tomoyasu* is solely with respect to the embodiments depicted with respect to Figures 35-43. However, these embodiments relate to a plasma CVD apparatus having a single high frequency power supply 728 connected only to the susceptor 712. (*Tomoyasu*, col. 16, l. 42 – col 18, l. 59; Fig 35.) In addition, *Tomoyasu*

fails to teach or suggest that the materials or processes disclosed therein may be interchanged, *i.e.*, that the etch chamber may be modified to run the disclosed CVD processes. Therefore, *Tomoyasu* fails to teach or suggest all of the limitations recited in each of independent claims 1 and 16.

Additional reasons for rejection under *Tomoyasu* are substantially copied from the prior rejection under *Pang*. As such, the same arguments detailed above with respect to functional language and inherent disclosure apply with equal force here. *Tomoyasu* fails to teach or suggest, either explicitly or inherently, a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor and at least one RF source coupled to the showerhead and the wafer support, as recited in claim 1, or a TDMAT and nitrogen gas source coupled to the showerhead for supplying a deposition gas mixture comprising TDMAT and nitrogen and a first RF source coupled to the showerhead, as recited in claim 16. Therefore, *Tomoyasu* fails to teach or suggest all the limitations recited in each of independent claims 1 and 16.

Thus, the Appellants submit that independent claims 1 and 16, and all claims depending therefrom, are patentable over *Tomoyasu*. Accordingly, the Appellants request the rejection be withdrawn and the claims allowed.

4. Claims 9 and 17, respectively depending from independent claims 1 and 16, stand rejected as being unpatentable over *Pang* in view of *Tomoyasu*. The Appellants disagree.

Claims 1 and 16 recite limitations not taught or suggested by the combination of *Pang* and *Tomoyasu*. As discussed above, *Pang* fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor, as recited in claim 1, or a TDMAT and nitrogen gas source coupled to the showerhead for supplying a deposition gas mixture comprising TDMAT and nitrogen, as recited in claim 16.

Tomoyasu, also discussed above, fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor and at least one RF source coupled to the showerhead and the wafer

support, as recited in claim 1, or a TDMAT and nitrogen gas source coupled to the showerhead for supplying a deposition gas mixture comprising TDMAT and nitrogen and a first RF source coupled to the showerhead, as recited in claim 16.

Moreover, there is no teaching or suggestion in *Tomoyasu* to modify the teachings of *Pang* in a manner that would yield the invention as recited in independent claims 1 and 16. As such, a *prima facie* case of obviousness has not been established because the combination of the cited references fails to yield all of the limitations recited in independent claims 1 and 16.

Thus, the Appellants submit that independent claims 1 and 16, and claims 9 and 17 depending therefrom, are patentable over *Pang* in view of *Tomoyasu*. Accordingly, the Appellants respectfully request the rejection be withdrawn and the claims allowed.

5. Claims 23 and 24 stand rejected as being unpatentable over *Tomoyasu* in view of *Davies* and *Sandhu*. The Appellants disagree.

Claims 1 and 16 recite limitations not taught or suggested by the combination of *Tomoyasu*, *Davies*, and *Sandhu*. As discussed above, *Tomoyasu* fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor and at least one RF source coupled to the showerhead and the wafer support, as recited in claim 1, or a TDMAT and nitrogen gas source coupled to the showerhead for supplying a deposition gas mixture comprising TDMAT and nitrogen and a first RF source coupled to the showerhead, as recited in claim 16.

Davies teaches a computer controlled system for processing semiconductor wafers. (*Davies*, col. 1, ll.1-54.) *Sandhu* teaches depositing a titanium nitride layer atop a semiconductor substrate using an organic precursor and subsequently forming a hydrogen plasma to remove carbon incorporated in the titanium nitride layer from the organic precursor. (*Sandhu*, Abstract.)

The Examiner asserts that the motivation for modifying the apparatus of *Tomoyasu* with the teachings of *Davies* and *Sandhu* is to enable the apparatus of *Tomoyasu* to deposit a titanium nitride layer and to subsequently expose the titanium nitride layer to a hydrogen plasma. However, the Appellants submit that the Examiner

is using impermissible hindsight reconstruction to combine references and arrive at the claimed limitations.

The Federal circuit has stated that "one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention." (*In re Fritch*, 23 USPQ2d 1780, 1784 (Fed. Cir. 1992)(quoting *In re Fine*, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988).) The teachings of the prior art may only be combined or modified to produce the claimed invention where there is some teaching, suggestion, or motivation to do so. The teaching, suggestion, or motivation must be found in the references themselves, either explicitly or implicitly, or in the knowledge generally available to one of ordinary skill in the art. (*See, MPEP* §2143.01.)

The Federal Circuit has repeatedly stated that in making a rejection under 35 U.S.C. §103, the Examiner must present "evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness." (*In re Lee*, 61 USPQ2d 1430 (Fed. Cir. 2002).) The Court in *Lee* stressed that "the factual inquiry whether to combine references must be thorough and searching" and must be "based on objective evidence of record," further stating that "[t]his precedent has been reinforced in myriad decisions, and cannot be dispensed with." (*Id.*); *see also, e.g., Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 56 USPQ2d 1456, 1459 (Fed. Cir. 2000); *C.R. Bard, Inc., v. M3 Systems, Inc.*, 48 USPQ2d 1225, 1232 (Fed. Cir. 1998); *In re Dembiczak*, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999)("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."); *In re Fine*, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988) ("teachings of references can be combined only if there is some suggestion or incentive to do so.")(quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 221 USPQ 929, 933 (Fed. Cir. 1984).)

"The need for specificity [with respect to the evidence of a teaching, motivation, or suggestion to select and combine the references] pervades this authority." (*Lee*, 61 USPQ2d 1430; *see also, e.g., In re Kotzab*, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000)("particular findings must be made as to the reason the skilled artisan, with no

knowledge of the claimed invention, would have selected these components for combination in the manner claimed"); *In re Rouffet*, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998)("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious."); *In re Fritch*, 23 USPQ2d 1780, 1783 (Fed. Cir. 1992)(the Examiner can satisfy the burden of showing obviousness of the combination "only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references").)

Here, there is no teaching, suggestion, or motivation contained in any of the cited references to combine them in the manner asserted by the Examiner. The Examiner has merely stated that the motivation for the combination would be to enable the apparatus of *Tomoyasu* to run the process of *Sandhu* with the controller of *Davies*. However, the Examiner has not pointed to anything in the cited references that would teach, suggest, or motivate the modification of *Tomoyasu* in the manner suggested by the Examiner. Nor has the Examiner cited any objective evidence of such motivation to combine the references contained in the knowledge generally available to one of ordinary skill in the art. Therefore, a *prima facie* case of obviousness has not been established because there is no motivation to combine the references in the manner suggested by the Examiner.

Moreover, even assuming *arguendo* that the references may be combined, the combination of the cited references still fails to teach or suggest the limitations recited in claim 1. Specifically, as discussed above, *Tomoyasu* teaches various embodiments of semiconductor processing apparatus. In the embodiments of a CVD apparatus, *Tomoyasu* fails to teach or suggest a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor and at least one RF source coupled to the showerhead and the wafer support, as recited in claim 1, or a TDMAT and nitrogen gas source coupled to the showerhead for supplying a deposition gas

mixture comprising TDMAT and nitrogen and a first RF source coupled to the showerhead, as recited in claim 16.

As such, even if one were to modify *Tomoyasu* to have the controller of *Davies* and a metallo-organic precursor or TDMAT gas source to perform the *Sandhu* process, the resultant combination would still fail to recite at least one RF source coupled to the showerhead and the wafer support, as recited in claim 1, or a first RF source coupled to the showerhead, as recited in claim 16. Therefore, a *prima facie* case of obviousness has not been established because any permissible combination of the cited references fails to yield the limitations recited in claims 1 and 16.

Thus, the Appellants submit that independent claims 1 and 16, and claims 23 and 24 respectively depending therefrom, are patentable over *Tomoyasu* in view of *Davies* and *Sandhu*. Accordingly, the Appellants respectfully request the rejection be withdrawn and the claims allowed.

CONCLUSION

For the reasons advanced above, Appellants respectfully urge that the rejections of claims 1-24 as being unpatentable under 35 U.S.C. §§102 and 103 are improper. Reversal of the rejections in this appeal is respectfully requested.

If necessary, please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 20-0782, and please credit any excess fees to the above referenced deposit account.

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CLAIMS APPENDIX

1. (Previously Presented) Apparatus for depositing and enhancing a nitride film on a semiconductor wafer comprising:

a process chamber;

a showerhead positioned within the process chamber;

a metallo-organic precursor gas source coupled to the showerhead for supplying a metallo-organic precursor;

a plasma annealing gas source coupled to the showerhead for supplying a plasma annealing gas;

a wafer support positioned within the process chamber;

a heater positioned proximate the wafer support, wherein the heater supplies sufficient energy to the metallo-organic precursor to decompose the metallo-organic precursor and deposit a nitride film; and

at least one RF source coupled to the showerhead and the wafer support, wherein the at least one RF source couples RF energy to the showerhead and the wafer support to produce an annealing plasma that improves resistivity of the nitride film.

2. (Original) The apparatus of claim 1, wherein the annealing gas comprises at least one of nitrogen and hydrogen.

3. (Original) The apparatus of claim 2, wherein the decomposition of the metallo-organic precursor deposits a film of titanium nitride upon a semiconductor wafer.

4. (Original) The apparatus of claim 2, wherein the depositing and annealing of the nitride film are both performed within the processing chamber.

5. (Original) The apparatus of claim 2, wherein the plasma annealing gas comprises at least one of nitrogen, hydrogen, helium, and argon.

6. (Original) The apparatus of claim 2, wherein the plasma annealing gas comprises nitrogen and hydrogen having a nitrogen to hydrogen ratio between about 3:1 and about 1:2.

7. (Original) The apparatus of claim 1, wherein the at least one RF source further comprises:

a first RF source coupled to the showerhead; and

a second RF source coupled to the wafer support.

8. (Original) The apparatus of claim 7, wherein the first RF source controls the plasma annealing and the second RF source provides a bias voltage on the semiconductor wafer.

9. (Original) The apparatus of claim 7, wherein the first RF source produces a first RF signal and the second RF source produces a second RF signal, and wherein the first and second RF signals are 180 degrees out of phase.

10. (Original) The apparatus of claim 1, wherein the metallo-organic precursor is tetrakis(dimethylamido) titanium (TDMAT).

11. (Original) The apparatus of claim 1, wherein the gas source supplies nitrogen

12. (Original) The apparatus of claim 11, wherein the decomposed metallo-organic precursor provides a metal that combines with the nitrogen to deposit a nitride film.

13. (Original) The apparatus of claim 1, wherein the wafer support is maintained at a temperature of between about 350 to about 450 degrees Celsius.

14. (Original) The apparatus of claim 1, wherein the heater is operable in the absence of a plasma.

15. (Original) The apparatus of claim 1, wherein the heater is operable with a plasma.

16. (Previously Presented) Apparatus for depositing and enhancing a nitride film on a semiconductor wafer comprising:

a process chamber;

a showerhead positioned within the process chamber;

a tetrakis(dimethylamido) titanium (TDMAT) and nitrogen gas source coupled to the showerhead for supplying a deposition gas mixture comprising tetrakis(dimethylamido) titanium (TDMAT) and nitrogen;

an annealing gas source coupled to the showerhead for supplying an annealing gas, the annealing gas comprising at least one of hydrogen, nitrogen, helium, and argon;

a wafer support positioned within the process chamber;

a heater positioned proximate the wafer support, wherein the heater supplies sufficient energy to the TDMAT to decompose the TDMAT and deposit a film of titanium nitride on the semiconductor wafer;

a first RF source coupled to the showerhead to control an annealing plasma using the annealing gas that improves resistivity of the titanium nitride film; and

a second RF source coupled to the wafer support to control bias of the semiconductor wafer while exposing the titanium nitride film to the annealing plasma.

17. (Original) The apparatus of claim 16, wherein the first RF source produces a first RF signal and the second RF source produces a second RF signal, and wherein the first and second RF signals are 180 degrees out of phase.

18. (Original) The apparatus of claim 16, wherein the wafer support is maintained at a temperature of between about 350 to about 450 degrees Celsius.

19. (Original) The apparatus of claim 16, wherein the depositing and annealing of the titanium nitride film are both performed within the processing chamber.

20. (Original) The apparatus of claim 16, wherein the annealing gas is hydrogen, and wherein the ratio of nitrogen to hydrogen is between about 3:1 and about 1:2.

21. (Original) The apparatus of claim 16, wherein the heater is operable in the absence of a plasma.

22. (Original) The apparatus of claim 16, wherein the heater is operable with a plasma.

23. (Previously Presented) The apparatus of claim 1, further comprising:

a control unit coupled to at least the process chamber, the control unit containing instructions which, when executed, cause the apparatus to form a metal nitride film from the metallo-organic precursor gas within the process chamber and to plasma anneal the metal nitride film using the annealing gas within the process chamber.

24. (Previously Presented) The apparatus of claim 16, further comprising:

a control unit coupled to at least the process chamber, the control unit containing instructions which, when executed, cause the apparatus to form a metal nitride film from the deposition gas mixture within the process chamber and to plasma anneal the metal nitride film using the annealing gas within the process chamber.